

What is claimed is:

1. A bone fixation system comprising:

an elongated plate having a top surface and a bottom surface and defining a plurality of holes between said surfaces, at least one of said plurality of holes including a spherical recess portion adjacent said top surface having a first diameter and defining an opening at said bottom surface having a second diameter less than said first diameter;

a first bone engaging fastener having a first elongated shank defining bone engaging threads thereon, a first enlarged head and a first intermediate portion between said shank and said head, said first shank having an outer diameter less than said second diameter so said first bone engaging fastener can be inserted through said at least one hole from said top surface of said plate, said first enlarged head defining a partially spherical surface complementary to said spherical recess of said at least one hole, and said first intermediate portion having a third diameter that is substantially smaller than said second diameter, whereby said first head of said first bone engaging fastener can be pivoted within said recess portion of said at least one hole so that said first bone engaging fastener can assume a plurality of angles relative to said bottom surface of said plate; and

a second bone engaging fastener having a second elongated shank defining bone engaging threads thereon, a second enlarged head and a second intermediate portion between said shank and said head, said second shank having an outer diameter less than said second diameter so said second bone engaging fastener can be inserted through said at least one hole from said top surface of said plate, said second enlarged head defining a partially spherical surface complementary to said spherical recess of said at least one hole, and said second intermediate portion having a substantially

cylindrical portion with a fourth diameter that is approximately equal to said second diameter, whereby said second head of said second bone engaging fastener cannot be pivoted within said recess portion of said at least one hole so that said second bone engaging fastener can assume a fixed orientation relative to said bottom surface of said plate.

2. A bone fixation system comprising:

an elongated plate having a top surface and a bottom surface and defining a plurality of holes between said surfaces, at least one of said plurality of holes including a spherical recess portion adjacent said top surface having a first diameter and defining an opening at said bottom surface having a second diameter less than said first diameter;

a bone engaging fastener having a elongated shank defining bone engaging threads thereon, a enlarged head and an intermediate portion between said shank and said head, said shank having an outer diameter less than said second diameter so said bone engaging fastener can be inserted through said at least one hole from said top surface of said plate, said enlarged head defining a partially spherical surface complementary to said spherical recess of said at least one hole; and

a locking screw assembly for locking said head of said bone engaging fastener within said recess portion of said plate, including;

a fastener bore defined in said plate adjacent said at least one hole;

a washer defining a central aperture and a recess communicating with said aperture, said washer further having an outer circumferential surface configured to contact said head of said bone engaging fastener when said bone engaging fastener is extended through said at least one hole; and

a locking fastener having a head configured to be recessed within said recess of said washer and an elongated shank extending through said central aperture and configured to engage said fastener bore of said plate.

3. A bone fixation system comprising:

an elongated plate having a top surface and a bottom surface and defining a plurality of holes between said surfaces, at least one of said plurality of holes including a spherical recess portion adjacent said top surface having a first diameter and defining an opening at said bottom surface having a second diameter less than said first diameter;

a bone engaging fastener having a elongated shank defining bone engaging threads thereon, a enlarged head and an intermediate portion between said shank and said head, said shank having an outer diameter less than said second diameter so said bone engaging fastener can be inserted through said at least one hole from said top surface of said plate, said enlarged head defining a partially spherical surface complementary to said spherical recess of said at least one hole; and

a locking screw assembly for locking said head of said bone engaging fastener within said recess portion of said plate, including;

a fastener bore defined in said plate adjacent said at least one hole;

a washer defining a central aperture and a recess communicating with said aperture, said washer further having an outer circumferential surface configured to contact said head of said bone engaging fastener when said bone engaging fastener is extended through said at least one hole, said outer circumferential surface having a concave curvature substantially corresponding to said partially spherical surface of said head of said bone engaging fastener; and

a locking fastener having a head configured to engage said washer and an elongated shank extending through said central aperture and configured to engage said fastener bore of said plate.

4. A bone fixation system comprising:

an elongated plate having a top surface and a bottom surface and defining a plurality of holes between said surfaces, at least one of said plurality of holes including a spherical recess portion adjacent said top surface having a first diameter and defining an opening at said bottom surface having a second diameter less than said first diameter;

a bone engaging fastener having a elongated shank defining bone engaging threads thereon, a enlarged head and an intermediate portion between said shank and said head, said shank having an outer diameter less than said second diameter so said bone engaging fastener can be inserted through said at least one hole from said top surface of said plate, said enlarged head defining a partially spherical surface complementary to said spherical recess of said at least one hole; and

a locking screw assembly for locking said head of said bone engaging fastener within said recess portion of said plate, including;

a fastener bore defined in said plate adjacent said at least one hole;

a washer defining a central aperture and a bottom surface configured to contact said head of said bone engaging fastener when said bone engaging fastener is extended through said at least one hole, said washer further defining a circumferential surface having a first portion overlapping said at least one hole when said washer is in a first position relative to said at least one hole and having a second portion that does not overlap said at least one hole when said washer is rotated from said first position to a second position, whereby said bone engaging fastener can be inserted through said at least one hole with said washer engaged to said plate when said washer is in said second position; and

a locking fastener having a head configured to be recessed within said recess of said washer and an elongated shank extending through said central aperture and configured to engage said fastener bore of said plate.

5. A bone fixation system comprising:

an elongated plate having a top surface and a bottom surface and defining a plurality of holes between said surfaces, at least one of said plurality of holes including a spherical recess portion adjacent said top surface having a first diameter and defining an opening at said bottom surface having a second diameter less than said first diameter;

a bone engaging fastener having a elongated shank defining bone engaging threads thereon, a enlarged head and an intermediate portion between said shank and said head, said shank having an outer diameter less than said second diameter so said bone engaging fastener can be inserted through said at least one hole from said top surface of said plate, said enlarged head defining a partially spherical surface complementary to said spherical recess of said at least one hole; and

a locking screw assembly for locking said head of said bone engaging fastener within said recess portion of said plate, including;

a fastener bore defined in said plate adjacent said at least one hole;

a notch defined in said plate adjacent said fastener bore;

a washer defining a central aperture and a recess communicating with said aperture, said washer further having an outer surface configured to contact said head of said bone engaging fastener when said bone engaging fastener is extended through said at least one hole, said washer further including a key adjacent said central aperture configured to seat within said notch in said plate to prevent rotation of said washer relative to said plate; and

a locking fastener having a head configured to be recessed within said recess of said washer and an elongated shank extending through said central aperture and configured to engage said fastener bore of said plate.

6. A bone fixation system comprising:

four bone engaging fasteners, each having an enlarged head and a threaded shank;

an elongated plate sized to span between at least three vertebrae, said plate defining two sets of two holes, each configured to receive said threaded shank of said bone engaging fasteners therethrough, a first set having a first hole aligned over a first vertebra and a second hole aligned over a second vertebra when said plate spans the vertebrae, and a second set having a third hole adjacent said second hole and aligned over the second vertebra, and a fourth hole aligned over a third vertebra adjacent the second vertebra; and

a pair of locking screw assemblies, one each for each of said two sets of two holes, each of said locking screw assemblies having a washer configured to overlap each of said two holes of said first and second sets when a bone engaging fastener extends through a corresponding one of said holes.

7. A bone fixation system comprising:
 - four bone engaging fasteners, each having an enlarged head and a threaded shank;
 - an elongated plate sized to span between at least three vertebrae, said plate defining a sets of four adjacent holes, each configured to receive said threaded shank of said bone engaging fasteners therethrough; and
 - a locking screw assembly having a washer configured to overlap each of said four holes when a bone engaging fastener is extended through a corresponding one of said four holes.

8. A bone fixation system comprising:
 - five bone engaging fasteners, each having an enlarged head and a threaded shank;
 - an elongated plate sized to span between at least three vertebrae, said plate defining three sets of two holes, each configured to receive said threaded shank of said bone engaging fasteners therethrough, a first set having two holes aligned over a first vertebra, a second set having one hole aligned over a second vertebra when said plate spans the three vertebrae, and a third set having two holes aligned over the third vertebra; and

a pair of locking screw assemblies, a first one of said locking screw assemblies disposed between said first set and said second set of holes and including a first washer configured to overlap each of said two holes of said first set and said one hole of said second set when a bone engaging fastener extends through a corresponding one of said holes, and a second one of said locking screw assemblies disposed between said second set and said third set of holes and including a second washer configured to overlap said one hole of said second set and each of said two holes of said third set when a bone engaging fastener extends through a corresponding one of said holes.